DETERMINING WATER CONTENT OF SILICA GEL USING THE LINDBERG FURNACE

Purpose

This Meteorology and Air Quality Group (MAQ) procedure describes the steps to determine the water content of silica gel to be used for the AIRNET ambient air sampling system by denaturing it in the Lindberg/Blue 1100 degrees C box furnace.

Scope

This procedure applies to AIRNET team members assigned to denature silica gel in the Lindberg/Blue 1100 degrees C box furnace at the TA-54 "Cave" and calculate the water content of the silica gel.

In this procedure

This procedure addresses the following major topics:

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Signatures

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General information about this procedure

Attachments

This procedure has the following attachments:

Number	Attachment Title	No. of pages
1	Hazard Review	2

History of revision

This table lists the revision history and effective dates of this procedure.

Revision	Date	Description Of Changes
0	06/16/05	New document.

Who requires training to this procedure?

The following personnel require training before implementing this procedure:

- MAQ AIRNET personnel assigned to use the furnace to denature the silica gel and/or calculate the water content

Training method

The training method for this procedure is **on-the-job** training by a previously-trained individual and is documented in accordance with the procedure for training (MAQ-024).

Annual retraining is required and the training method will be **self-study (reading).**

Prerequisites

In addition to training to this procedure, the following training is also required prior to performing this procedure:

- First Aid
- Cardiopulmonary Resuscitation (CPR)

General information, continued

Definitions specific to this procedure

None.

References

The following documents are referenced in this procedure:

- MAQ-024, "Personnel Training"
- MAQ-204, "Sampling of Ambient Airborne Tritium"

Note

Actions specified within this procedure, unless preceded with "should" or "may," are to be considered mandatory guidance (i.e., "shall").

Denaturing the silica gel

Description of process

Water content of new lots of silica gel may vary from other lots. There also may be some variation within lots. Several cans of silica gel are mixed together using the 55-gallon mixing drum then returned to the cans to be oven dried (according to "Drying the silica gel" in chapter *Preparation of silica gel cartridges* in MAQ-204, "Sampling of Ambient Airborne Tritium"). *Denaturing* heats the silica gel to an extreme temperature at which no water remains, thus allowing the calculation of the "bound" water that is in silica gel. A new determination of water content must be made with every new lot.

Equipment needed

Collect the following supplies and equipment:

- 7 nickel-chromium crucibles
- 2 cans of oven-dried silica gel
- "Bound Water Corrections Worksheet", printed from AIRNET database page "Gel Bound Water Form"

Steps to denature silica gel

To denature silica gel and determine water content, perform the following steps:

Step	Action
1	Weigh the 7 empty crucibles with their lids. Numbers 1-7 are etched on the sides of the crucibles and on their associated lids. Record the data on the "Bound Water Corrections Worksheet".
2	Take 2 cans of oven-dried silica gel and partially fill the 7 crucibles: • 2 crucibles from the top of 1 can • 2 from the top of the second can • 2 from ~2/3 down the first can • 1 from ~2/3 down the second can. Record data on the "Bound Water Corrections Worksheet".
3	Weigh each setup of crucible, lid, and silica gel and record the data on the worksheet.
4	Place the crucibles in furnace and program to heat at 1000° C for two hours. **WARNING: furnace becomes very hot.** Place warning sign in front of oven to notify others.
5	Whenever possible, remove items only after the oven has cooled. Only if necessary, use tongs to remove crucibles from hot furnace. Wear gloves and eye protection and stand back when opening hot furnace. When crucibles are cool enough to handle, weigh and record.
6	Record the silica gel lot number and can number on the worksheet.

Calculating Water Content

Calculate the water content

Calculate the water content by entering all data in the AIRNET database.

Steps to enter data

To enter data and calculate the water content, perform the following steps:

Step	Action
1	From the AIRNET Main Switchboard – Field Sampling – Gel Bound Water, click on “Create new correction”. Enter silica gel lot number being analyzed into popup form.
2	Record the following data: • silica gel lot number being analyzed • silica gel can numbers • position of the silica gel removed from the can • crucible number • weight of the empty crucible and lid • weight of the un-denatured gel + lid + crucible • weight of the denatured gel + crucible + lid • gel weights
3	Check entries. If they are correct, click on “Perform Calculations”.
4	Repeat steps 2 and 3 for all data.
5	Enter the first sample period for which the new lot will be used into “Effective PeriodID of Correction”.
6	Click on “Compute Average Correction and Load into Results Table”.
7	Print report for logbook and paste copy into AIRNET field logbook.

Records resulting from this procedure

Records

The following records generated as a result of this procedure:

- Entries made on datasheet and placed in logbook

Note: Electronic data are stored on the network and backed up according to network backup procedures.

HAZARD REVIEW FOR DETERMINING WATER CONTENT OF SILICA GEL USING THE LINDBERG FURNACE

Work tasks/Steps	**Hazards, Concerns, and Potential accidents; Likelihood/ Severity**	**Controls, Preventive Measures** *(e.g., safety equipment, administrative controls, etc.)*	**Hazard Level** *from IMP 300-00-00 Hazard Grading Matrix*
Use oven according to steps in this procedure (MAQ-257).	Thermal burns to user and others. Moderate / occasional = Low	Read pertinent instructions and safety considerations in manual prior to use. Place warning sign near oven to warn others that it is use. Avoid removing items from hot oven – wait until it has cooled. Only if necessary, use tongs to remove crucibles from hot furnace. Wear gloves and eye protection and stand back when opening hot furnace. Don't touch hot surfaces!	Low

Wastes or residual materials resulting from process

Denatured silica gel: Dispose in normal trash.

Emergency actions to take in event of control failure

For all injuries, provide first aid and see that injured person is taken to Occupational Medicine (only if immediate medical attention is not required) or the hospital. Notify supervisor and group office as soon as possible.